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ABSTRACT

The development of a principled microcomputer-based adventure game that simulates the experience of higher education for prospective students in British schools is discussed. Playing the game is intended to provide prospective students a "realistic role preview." Consideration is given to an earlier board game and research on student learning on which the simulation was based. The simulation allows students to try different study strategies and provides advice tailored to the specific strategies used by the individual student when interacting with the computer. The design of the computer simulation is described, along with the strategies to ensure that the game and advice are controlled by principles derived from student learning research. Examples show how a student would experience the interactions with the computer, and how the rules provide tailored advice. The simulation can be seen as a simple expert system providing a form of intelligent tutoring. The game is used with the Macintosh microcomputer, backed by memory on hard disk. The game is made up of six scenes: freshman week and course choices, choice of options, introductory tutorial, lectures and independent study, balancing social life and work, and preparing for and taking tests. (SW)

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ANTICIPATING THE EXPERIENCE OF HIGHER EDUCATION THROUGH COMPUTER SIMULATION

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ABSTRACT

In industry the advantages of 'realistic job preview' have been much discussed, but little is currently done in British schools to prepare students for higher education. This article describes the development stages of a principled adventure game to simulate the experience of higher education. Playing this game is intended to provide 'realistic role preview' for prospective students.

The simulation has been developed out of an earlier board game derived, to some extent, from research findings. More recent research on student learning has provided the principles on which the new simulation game is being based. The game not only allows students to try out different study strategies, it also provides advice tailored to the specific strategies used by the individual student in interacting with the computer. This simulation can be seen as a simple expert system providing a form of intelligent tutoring.

The architecture of the computer simulation is described, together with the strategies used to ensure that the game, and the advice provided, are both controlled by principles derived from the research on student learning. Illustrations are used to indicate how a student would experience the interactions with the computer, and how the rules produce tailored advice.

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Realistic Role Preview

Higher education differs significantly from school education in the degree of autonomy in studying and everyday living offered to the student. The initial experience of higher education can be bewildering and the types of studying required can be unfamiliar. This potential difficulty has been widely recognised, although rather little research has been carried out to investigate the types of difficulties reported by the students themselves (Raaheim and Wankowski,1981). In Britain, some schools provide opportunities for students to experience lecture and tutorial teaching, and to work independently to a considerable extent. In higher education, too, most institutions now provide a 'Freshers' Week' which introduces entrants to its academic and social activities, and some institutions also offer study skills workshops to draw attention to the types of studying which they expect of

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students. Yet many students still appear to be underprepared for the challenge of higher education and some seem to find it very difficult to settle in. Indeed there is evidence to suggest that some students spend a good deal of their first year coming to terms with the new environment (Thompson,1981). It is not just that the types of studying are unfamiliar and there is more independence in planning work, but many students are away from home for the first time and so face many new demands and responsibilities.

The idea of preparing newcomers for the demands of a new working environment is, of course, of importance in industry and there already exists a literature on 'realistic job preview' which suggests some of the ways in which entrants can be led to anticipate job requirements more accurately (Wanous,1980). Typically, job applicants are shown films or given talks which explain the job requirements and describe the working environment. Where such previews provide a unbiassed picture of the work experience, there is evidence that they do increase job satisfaction and reduce turnover of staff. But it is far from clear how this technique works. One suggestion is that it serves to 'vaccinate' expectations - to make them more realistic (Premack and Wanous,1985). As students have been found to have stereotypic, naive, and over-optimistic expectations of higher education (Wanous,1976; Raaheim and Wankowski,1981), such 'vaccination' of expectations may also play a valuable role in the transition from school to higher education.

In any business organisation there would be some initial training to ensure that newcomers acquire any new skills involved. Higher education institutions in Britain have tended, in the past, to assume that the careful monitoring of entrance qualifications is a sufficient guarantee of adequate preparation for studying. But this assumption fails to take account of the considerable differences between the experiences faced by students at school and after they enter higher education. In recent years there has been a substantial growth in research into the experiences of students in higher education. There is thus a body of sound information which could be provided for students to help them more realistically to anticipate the transition from school to higher education. There is still, however, a formidable barrier. Simply telling students what to expect is unlikely to be effective. The experiences are too novel and too complex for information alone to prepare students adequately for what is to come.

As in industry the use of simulation techniques may be an answer. This paper describes an attempt to develop a principled microcomputer-based adventure game which would provide, in effect, a 'realistic role preview' for prospective entrants into higher education. It was based, in part, on a board game which had already been used with students. But it also depended on identifying and organising a body of relevant research literature on student learning and providing a computer-based learning environment in which students could explore different strategies for coping with a simulated higher education environment and consider the consequences of their choices and actions within the game. This paper reports the design stage of this project. The game itself has yet to be put into operation.

The Development of a Simulation Using a Board Game

The board game emerged as a way of presenting research findings on studying to students. The research study itself was designed to identify factors associated with success and failure in higher education. Longitudinal studies were used to compare student characteristics, assessed before entry and during the first year, with subsequent academic performance (Entwistle and Wilson,1977). Although the levels of prediction achieved were modest, the analyses did point to some interesting inter-relationships between ability, personality, motivation, and study methods. Further exploration of these relationships using cluster analysis led to the identification of distinctive 'types' of student who appeared to have different forms of motivation. One group was competitive and self-confident. Another was independent-minded with wide ranging academic interests, while a third group was anxious and lacking in self-confidence. The final main type was described, somewhat disparagingly, as 'idle and unmotivated'.

Interviews with students drawn from these 'types' suggested that they were reacting in very different ways to the situations they were meeting in higher education.

> **Students of differing personality and motivational types not only tackle their academic work in different ways but, from descriptions of their university experience, they evidently perceive themselves to be in differing environments . (Entwistle, Thompson and Wilson,1974, p.393)**

Although some of the findings seemed to have significance for students, it was recognised that it would be difficult to present them in ways which would cause students to reflect seriously on their existing study methods. Thus the idea of using a game format was explored. Progression through higher education was imagined as a form of obstacle race. Students set out on that race with different starting conditions or 'handicaps', depending on their ability and school attainment. They also had differing personalities and motivations which would lead them to react differently to the obstacles they met during their course. These ideas were incorporated into *The Academic Achievement Game* (Entwistle and Wilson,1977)

[*Figure 1 about here*]

A board game similar to Monopoly (Figure 1) was developed in which progress was determined partly by the throw of a dice and partly by instructions related to the square on which they landed. Students were invited initially to choose one of three tracks (*Arts, Social Science, or Science*). They were then allocated one of three types of dice (numbered 1-6, 2-7 and 3-8) which represented different levels of ability and strongly controlled the rate of progress around the board. They were also given a starting condition based on their school achievement record Finally students were also provided with one of four different coloured counters which would indicate their position on the board The colours represented the contrasting student 'types', mentioned earlier, and these types determined their predicted reactions to the events 'experienced'.

The game was intended to introduce students to the idea that they could expect to react differently to the experiences they met in higher education, depending on personality. Events were introduced in the form of coloured squares representing 'hazards', 'bonuses', or 'chance'. Landing on one of these squares directed students towards packs of cards which described events they had experienced. The effects of these events were related to the personality to which the student had been assigned. Thus "Your flat mates interrupt your work" was a hazard which had the greatest effect (sent back 6 squares) on the idle and unmotivated, while "Your tutor is very sarcastic" affected the anxious students most severely. A bonus such as "Your tutorial group is stimulating and constructive" was most beneficial to the sociable and to the well-motivated students, while the idle and unmotivated were helped most by "Your adviser discusses your career with you".

The 'chance' pack allowed some changes in the main controlling features of the game - ability level and student type. Thus picking up the card saying "Your study methods are increasingly effective" evoked the rule

> **If *moderate* or *low ability* change to next higher dice. If *higher ability* take one free throw (Entwistle and Wilson,1977, p.153).**

The game was used with both secondary school pupils and entering students, with some success. It helped them to anticipate some of the situations they would find in higher education, and it stimulated discussion. But its effectiveness was reduced by the limited extent to which individual 'debriefing' was possible afterwards, and students thought that the game was controlled, to an unrealistic extent, by starting conditions and by chance (Wilson,1978). Students wanted opportunities to interact with the situations and to vary their strategies as a result of their experiences, but that was impossible within the format of the board game. There was also a recognition by the researchers that the situations, and students' predicted reactions to them, were drawn mainly from personal experience, rather than from a systematic study of the effects of academic contexts on student learning. Ideally the events and consequences should be drawn from research findings. For this, a different type of research was needed.

Concepts and Research Evidence on Student Learning

The early research had identified some of the student characteristics associated with academic progress, but had not looked at these in relation to pertinent features of the academic context - in particular, methods of teaching and assessment. The responsibility for success or failure was thus implicitly being placed on the student, as if the academic staff and the institutional resources and policies had no influence on learning outcomes. The relationships between student characteristics and academic outcome were thus essentially decontextualised, in common with much of the educational research of that time.

Work in the USA had begun to draw attention to the importance of describing differences in institutional climate (Pace,1967) and to the way

that the 'hidden-curriculum' and assessment procedures affected students' social behaviour and academic work (Becker, Geer and Hughes,1968; Snyder,1971). The next step forward in research involved looking at the processes of learning in higher education and to consider how these were affected by the whole institutional environment. A series of studies in Sweden, Britain and Australia (Marton, Hounsell and Entwistle, 1984; Entwistle and Ramsden,1983; Biggs, in press) provided the concepts, categories, and the principles from which the adventure game has since been developed.

One of the first investigations into the processes of academic learning was carried out by Marton (1976). He has pioneered the systematic description of students' experiences and perceptions of the content and context of academic learning. His first study investigated students' ways of reading an academic article. The concept emerging from his analyses was *approach to learning* with its two main categories of *deep* and *surface* (Marton & Saljo,1984). The main defining feature of each of these categories was the intention shown by students as they read the article - either to seek personal understanding or minimally to meet the task requirements. The subsequent contrasting learning processes were seen to be a product of the initial perceptions of the task in relation to the student's own intentions.

These ideas were extended by Pask (1976) who was able to show that, even when students were required to demonstrate personal understanding, there were still two characteristically different *learning styles* involved. He distinguished between *holists*, who sought to personalize knowledge and to interrelate ideas extravagantly, and *serialists*, who preferred a narrow focus, concentrating cautiously on details and logical connections.

A five-year research programme at Lancaster (Entwistle and Ramsden, 1983) sought to extend this research by seeking confirmation of the conceptualisations and by investigating the factors affecting the adoption of these approaches and styles. Interview and inventory data were used to demonstrate a clear distinction between deep and surface approaches across six contrasting academic disciplines. It was, however, found necessary to introduce a further category - the *strategic approach* - in which the main intention was to obtain the highest possible grades by being alert to cues from lecturers and also through being well organised in both *study methods* and *time-management* (Entwistle and Kozeki,1985)

Other analyses showed that learning styles were related, to some extent, to underlying personality characteristics, while approaches to learning were associated strongly with contrasting forms of motivation - *intrinsic* (with deep), *fear of failure* (with surface) and *need for achievement* (with strategic). But these approaches were also influenced by the students' perceptions of the ways in which they were taught and assessed.

In interviews, students were asked what influenced their approach to learning, and a questionnaire was developed to assess their perceptions of the department in which they spent most of their time studying (Ramsden, 1981). Combining results from both types of data, it emerged that a deep approach was consistently facilitated by *good teaching* and by being given

freedom in learning (both in what to learn and in how to learn it) (Entwistle and Ramsden,1983). A surface approach was found to be partly attributable to *assessment procedures* which required only detailed factual responses, and to a *heavy workload*. It was also induced by lecturers who, often unconsciously, fostered dependency through *learning materials* which 'spoon-fed' the students with pre-digested information, so limiting their personal involvement in learning (Selmes,1987).

These components of the learning context were subsequently incorporated into a heuristic model designed to draw attention to the interactions between the participants - students and teachers - and the learning contexts within the academic departments (Entwistle,1987,a,b).

The Development of the Computer-Based Simulation

PRINCIPLES UNDERLYING THE DESIGN

This series of research studies, together with the heuristic model, provided the basis for the computer simulation. The original board game could have been strengthened just by the use of experientially rooted concepts describing processes of studying and by the greater precision with which events and their probable consequences could now be predicted. Parallel developments in microelectronics (Odor,1986) also made it possible to offer students an interactive simulation of some typical situations in higher education which would allow them to vary their strategies and to consider the consequences of using them. Besides helping prospective students in the secondary schools, it was envisaged that parts of the game would also provide study skills support for those already in higher education.

The intent was to develop a 'principled adventure game'. In the previous game students were allocated different starting conditions randomly. As an integral part of the computer simulation a realistic model of the student was required which would describe the student's ways of studying in terms of the concepts outlined in the previous section. That model would have to be derived initially from inventory scores, but would then be modified from the decisions made by the students in interacting with the game itself. The model would determine, to some extent, how the student was led to 'perceive' situations and so would influence choices and strategies. The consequences of events would be determined, as far as possible, from the research findings. It was decided, as a matter of principle, that the game should not be a 'black box'. The student would be able to interrogate the game to discover the rules which had determined the consequences of actions. Periodically the student would also be able to seek advice on improving strategies within the game, which would be presented in ways designed to highlight connections with real life studying.

In essence the design of the game thus envisaged a data base of information about studying, derived from research studies, together with advice tailored to the decision strategies and inferred characteristics of the individual student. In other words, it would be a simple expert system providing a form of intelligent tutoring.

THE ARCHITECTURE OF THE COMPUTER SIMULATION

A crucial next step in the project involved the development of a model to summarize the various processes to be built into the computer simulation - the 'architecture' of the system design (see Figure 2).

[*Figure 2 about here*]

The central feature of the architecture is what has been called the *theatre*. This is where the simulated events are presented as displays on the computer screen which invite the student to make choices and so to develop a game strategy. A series of interlinked events and actions are built up into a coherent *scene*, as in any dramatic production. The student progresses through a succession of scenes chosen to represent typical academic and social situations met in higher education and developing in a natural sequence.

The second major feature of the architecture is the *blackboard* which records the current state of the student model in terms of a profile of inventory scores updated on the basis of interactions with the game events. The set of variables used to describe the student was developed from the literature review summarized in the previous section and has been reported elsewhere (Entwistle, Odor and Anderson, in press). Estimates of the current level of these variables for the student will be held on the blackboard, together with information about the stage reached in the game and any additional messages intended to affect the future presentation of aspects of the game. The blackboard will also record every keyboard interaction made by the students, including any comments made by them on their experiences with the game. After each interaction the blackboard will be updated, and at the end of each event or scene the contents of that particular blackboard will be recorded, to produce a *history* formed from the succession of blackboard states.

As students interact with the scenes in the theatre, they choose from a set of *control words* which determine their movement through the scene. Some of these will be familiar from adventure games (e.g. 'look', 'ask', 'go to' or 'help'). Other control words will be specific to the game or to a particular scene. Two such control words, CHORUS and COMMENT, are available after any event.

The term CHORUS was chosen by analogy with the Chorus in a Greek play who comment on the developing plot. Our 'chorus' will provide a brief justification for the appearance of the existing screen display in terms of the rules or the theoretical background. Students will also be encouraged to type in their own COMMENT on the last event or scene, in relation either to the simulation or to real-life experiences.

At the end of each scene a MENTOR will be available. This control word will first provide a rationale for the main events occurring in that scene and will then offer optional advice. Some of the advice will be couched in general terms, but there will also be individually tailored advice, based on the history of the student's interactions with previous events and on estimates of the student's own study characteristics held on the blackboard. MENTOR will also introduce students to the meaning of the main concepts

from the research literature on student learning to allow subsequent advice to be couched in those terms.

The scenes, and the advice, are presented to the student through blocks of predefined text which are displayed on the screen as appropriate. The decision about which block of text to display is determined by rules associated with each component of the event. The rules are often written in terms of the variables which make up the student profile and in this way the game can introduce contrasting 'perceptions' of the same events, thus paralleling the research findings. to some extent.

The rules will be interpreted and executed by a specially written program, described as a *game controller*, which will also make and amend entries on the blackboard and carry out pattern searches through the history of the student's previous interactions with the game. The writing of this controller is a major challenge for the next phase of the project, although a substantial amount of preparatory work has been carried out and reported (Odor,1986).

The game is to be implemented on a Macintosh microcomputer, backed by substantial memory on hard disk. This machine was chosen because of its windowing and 'pull-down menu' facilities, and its general 'user friendliness'

TWO ILLUSTRATIVE SCENES - EVENTS, RULES, AND ADVICE

The only way really to understand any simulation game is to play it. Here verbal descriptions have to be used to convey an impression of the scenes and events. The overall game is made up, at present, of six scenes.

- ◇ Fresher's week and course choices
- ◇ Choice of options
- ◇ Introductory tutorial
- ◇ Lectures and independent study
- ◇ Balancing social life and work
- ◇ Preparing for and taking exams.

Scene Two: *Choice of Options*

The second scene can be used, first, to illustrate how students make the choices which determine their progress through the game. The intention in this scene, *Choice of Options*, is to help students realize the need to base decisions on full information which may not always be readily available and may have to be actively sought out. The opening event places the student in the office of their Director of Studies, with the task of choosing an optional course. The Director of Studies reads out a list of four course titles from the University Prospectus he is holding and asks the student to decide which of them to take.

This is the first choice point and the next text shown to the student depends on that choice. The control words are hidden at this stage - a device used to simulate the feeling of helplessness which many 'freshers' feel in such situations. The hidden control words can be activated if the student

types in one of them in seeking to take charge of the situation. For example, any combination of words with *prospectus* will show the student that the information there is too brief to be helpful. Typing words associated with asking *advice* will lead to an admission from the Director of Studies that he knows no more than is shown in the prospectus.

There is no full language analyser built into the game controller; it is simpy provided with a set of probable words. Here it has (ask/advice/tell/*) (Director of Studies/options/courses), the asterisk allowing any other word to be used instead. If the student does not make a recognisable choice, or is unable to make any progress, there is a pull-down menu which shows the hidden control words available for use at that time.

In this situation, of course, there is pressure on the student to make an immediate choice of options there and then. If that happens the scene ends with a cautionary comment shown when the game controller has established that the student's past history of interactions with the game does not contain the event in which further information can be obtained.

As you are leaving, you overhear the Director of Studies muttering "I really don't know how they can take these important decisions without bothering to find out more about ....." The door closes.

Rule: NOT (PAST (HAS E'706'))

If the student persists in trying to obtain information, the Director of Studies will suggest that the department has more detailed course descriptions. When the student uses the 'go to' control word, various opportunities to obtain information are then provided. The scene shifts to an entrance hall in the department where there is a noticeboard - but this provides little additional information. The really useful guidance comes implicitly from meeting staff and explicitly from talking to second-year students. To continue the feeling of unfamiliarity, it is made fairly difficult to find people and to gain access to information. Finding the departmental secretary is an important step in learning how to understand the geography and the workings of the department. She provides local knowledge and support, but perseverence is still required.

The student model is used on several occasions in this scene to present differing perceptions of situations to students with different characteristics. This technique is intended to parallel the findings in the research on student learning, which emphasized that the contextual influences on learning are indirect. Those effects depend on the student's own perception of the situation,which in turn is a function of the student's personality and past experiences (Entwistle,1987). Here, on entering the department, for example, the student is given the opportunity to find out about the courses both from the noticeboard and from other students. But the descriptions have been designed to make it less likely that an introverted student will speak to the students. The game controller is instructed, at this point, to check the student's profile for the level of 'extraversion' currently shown. Then alternative texts are shown depending on that level.

You notice out of the corner of your eye that the group of students drinking coffee in the corner is breaking up. They are still busy talking, but seem friendly.

Rule: Extravert (high)

You notice out of the corner of your eye that the group of students drinking coffee in the corner is breaking up. They are deep in conversation and don't seem aware of your existence.

Rule: Extravert (low)

Again if the student seeks out the lecturers, they are perceived in different ways. In this case the match between learning style and teacher personality is used to determine the impressions made on differing students. Their reactions to a disorganised, but enthusiastic, lecturer are presented in contrasting ways. The student had tried, unsuccessfully, to see the lecturer before. This time :

There is still no-one in, but you wait. After a while a large and cheerful man arrives and greets you effusively. He pushes you into the room and clears a pile of papers from a chair. He asks you who you are and how you are enjoying life at university. Eventually you manage to ask about his course. He launches into an enthusiastic description of his latest research. It sounds interesting, but really rather complex and confusing. You wander back towards the entrance hall, trying to work out what the course itself might be about, but feeling that the lecturer himself was friendly and enthusiastic.

Rule: Holist (high) AND Serialist (low)

The initial description is the same for both matched and mismatched conditions, but the reactions of the student with a serialistic learning style are presented as being less favourable. The text block ends with

about. You feel that the lecturer was friendly, but disorganised and confusing.

Rule: Holist (low) AND Serialist (high)

The intention here is to mimic the contrasting perceptions of differing personal styles, but to avoid being too coercive on the student's ultimate choice of option course. If the student still chooses a mismatched lecturer, and the estimate of the student's learning style stays the same during the next scene, difficulties of comprehension will be introduced into the student's subsequent experiences of the lectures in that course.

Scene Three: *Introductory Tutorial*

The intention here is to help students recognize the need to prepare for tutorials, to plan ahead in obtaining books, to experience the frustration of not finding books in the library, and to provide advice on what tutors expect

of students in the tutorials themselves. The scene also introduces students to the concept of 'approach to learning' through their experiences in reading an article in preparation for the next tutorial. The scene is set as follows:

It is coming towards the end of your first tutorial. Students are beginning to click their files and generally indicate that it is time to go. The tutor eventually takes the hint, but gets up and writes the title of an article on the board. He says:

"I want you to read that article for next week: we'll see what you've made of it then. There should be a copy of that journal in the Reference Room. The article also appeared in a set of readings edited by . . I think it was Davidson. We did order a copy for Short Loan so I think you will *probably* be able to get hold of it without too much difficulty."

You make a dive for the door: it's definitely time for coffee.

There is no choice to be made. The student expects the scene to shift to the coffee bar. And for most students this will happen. But the game controller is again instructed to examine the student's profile. Here it checks on the levels on strategic approach and time-management. If both of these are currently categorised as 'high', the student will be sent direct to the library, instead of to the coffee bar. If the student interrogates the computer, through the CHORUS option, about this unexpected change, the screen will show:

You seem to be alert to the need to plan your time carefully and strategic enough to pick up the lecturer's hint, so you are expected to go to the library straight away.

Rule: Strategic (high) AND Time-Management (high)

All the other students find themselves in the coffee bar where the conversation turns to the possible difficulties in getting hold of the article. They are then offered the choice of going home to work on an essay or going to the library. If they decide to look for the article immediately, their score on 'strategic approach' will be increased at the end of the scene. If not, it will remain the same. When the students do go to the library, they locate the Reference Room easily enough, but find that the relevant journal is missing. They move on to the Short Loan library, but if they have delayed going there, they will find that the book containing the article is out. These experiences are intended to alert newcomers to the logistic difficulties experienced in using an academic library.

Once they have obtained the article, the game controller interprets which experience of reading the article will be presented. Time-management is again involved, but also approach to learning. The text presents deep or surface approaches read with or without awareness of time. For example, the rule *NOT (Deep Approach (high) OR Surface Approach (high) OR Time-Management (high))*, if matched by the student's current profile, produces a description of a disorganised surface approach to reading.

You look at the article, but you are not at all sure what you are supposed to get out of it. Are you supposed to 'learn' it - to try to remember all the details ? Or will you be asked to join in a general discussion ? You decide to try to cover both possibilities. You read the *Abstract* carefully and then begin to read the article slowly and carefully. You note down any fact or idea which seems important. However, you are not getting on very fast. All of a sudden you realize that you have a lecture in ten minutes. You rush through the rest of article without any chance to take any more notes. There is no time to come back to the library. You are left feeling anxious about the coming tutorial.

As it is not possible within the game to assess the approach to learning directly, students are given the opportunity to indicate immediately after this event to what extent that description of their reading seems truly applicable to them. They can indicate that they would concentrate more, or less, on meaning or details, or be more, or less, aware of time constraints. Their own estimates are then be used to modify the profile on the blackboard.

When the students attend the next tutorial the game controller is asked to examine the 'history' to see how well they had prepared the article and also to check levels of 'extraversion' and 'fear of failure' in the profile. Anxious introverts are then depicted as being reluctant to join in the discussion and as finding the experience of tutorials threatening and unrewarding. Students who are self-confident extraverts are shown as dominating the proceedings to an extent which other students find unacceptable, while those who adopted a surface approach to the reading find the tutor unimpressed by a catalogue of accurate facts. If a 'surface' student is puzzled by the tutor's reaction, interrogation of CHORUS would contain.

As you seem to have put too much effort into trying to learn details from the article, you found the tutor's broadly-based questions difficult to answer.

Rule: Surface (high) AND NOT Deep (high)

At the end of the scene, the students have the opportunity to ask the MENTOR to comment on the rationale behind the scene as a whole, and to provide advice in relation to the choices and strategies they have used in the scene. The MENTOR explains initially what the scene was intended to demonstrate to the student, and then invites the student to seek more individualised advice based on the specific choices made during that scene.

This scene was intended to suggest that:

A - tutors' comments about articles need interpreting
B - articles may not be easy to obtain in the library
C - articles have to be read for evidence and argument
D - in reading an article allocate time appropriately
E - tutors generally expect you to have your own ideas
F - tutorials involve speaking out and giving way
G - tutorials show you how to think about the discipline and allow you to check understanding of lectures

If you would like advice about any (more) of these ideas, please type the appropriate capital letter, otherwise go on to the next scene.

The next set of advice introduces concepts and findings from research and also 'folk wisdom' about studying. Here, students typing 'C' will have the ideas of deep and surface approaches to learning introduced. The advice at this stage may also be tailored to the specific text blocks the individual student was shown and the specific choices made. Thus a student typing 'F', and currently characterised in the profile as as an extravert, will be given 'intelligent' tutoring which contains a warning about inappropriate behaviour.

Tutorials have sensitive social dynamics. They depend on the tutor encouraging all the students to contribute, without applying the sort of pressure which creates anxiety. Many students lack confidence and are very susceptible to criticism, particularly when they are just starting a course. Each group, however, is likely to have someone who is extraverted and self-confident. The danger is that such a person may dominate the discussions to the annoyance of the others, who soon get tired of his or her views. In this scene you were portrayed as behaving like that, and the coolness at coffee afterwards reflected the others' resentment of that behaviour. If you really behave like that, remember that joining in is fine but you also have a duty to the rest of the group. It will be better if you try to support the less confident members of the group. Don't try to score points: neither the tutors nor the other students will appreciate it.

Rule: Extravert (high) AND Self-Concept (high)

For the anxious student lacking in self-confidence, the advice changes half-way down the text block, after the same initial description.

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the annoyance of others, and making more sensitive students very anxious and uncertain of themselves. In this scene, you were put in this position. If, in reality, you do find it difficult to join in easily, first it is important to realize that many other students feel the same. But you do need to join in. It may help to start by making a note of any idea that occurs to you, and then making a very brief remark based on your note. Your first attempt may well be hesitant and confused, but confidence grows with practice.

Rule: Fear of Failure (high) AND Self-Concept (low)

Development strategy for a principled adventure game

The scenes for the theatre were built up from a story-board which provided the overall shape of the game, and a story-line developed within each scene. To ensure that the game was 'principled' it was essential to construct scenes and events in ways which fulfilled principles derived, as far as possible, from research findings on student learning. This systematic strategy held in abeyance the imagination necessary to create believable scenes, but the benefits in overall coherence were considerable.

THE STORY-BOARD

The story-board was build up by choosing and ordering a set of scenes which would sample salient features of a student's first-year experiences in higher education. The scenes are experienced by the student in the same order, representing a natural progression through an academic year. Besides this fixed sequence of main scenes there will, however, also be *variable events*, some introduced at random, such as 'illness', and others triggered as consequences of earlier choices and the student's profile. For example, a student who chooses courses without due care may be faced with a substantial overload of work through an unfortunate, but avoidable, combination of courses. If the student was also categorized as being anxious, the consequences would become more severe.

The events to be included in the game as a whole were derived from models based on the original heuristic model (Entwistle,1987,a,b). That model, in itself, was not directly suitable for this purpose, being designed to highlight the teacher's perspective. Alternative models were created which presented components of the teaching-learning situation from the student's perspective and at two distinct levels (Entwistle, Odor and Anderson, in press). One contained a *concepts world* which was used to describe the student profile and to frame the advice on study stategies. The other was an 'events world' which contained concrete experiences described in the language used by the students themselves - such as course choices, workload, working conditions, social life, and library facilities. This latter model guided the incorporation of specific events into each scene.

As the consequences of events and the selection of appropriate text blocks depend, in part, on the student profile, it was necessary to obtain initial estimates for the profile as soon as possible. Thus, in the first scene - *Freshers Week* - students have an 'accidental' meeting with a researcher who persuades them to complete a 'study methods inventory'. The responses are scored by the computer to produce the initial student profile.

CONSTRUCTING EVENTS

Once the specific concepts and advice had been systematically allocated to each scene, the story-line within the scene was built into a believable scenario by using imagination, tacit knowledge, and personal experience. It was essential to persuade students that the events and consequences depicted on the screen could really happen to them. In this way, transfer between game events and studying in real life would be more likely.

Once the story-line had been created, it had then to be converted into a form which could be interpreted by the game controller. This was achieved by writing a series of text blocks to depict the events on the computer screen. Each text block was associated with control words which allowed the student to interact with the game, and with rules which controlleed the next text block to be seen. A special syntax was developed to allow the game to be written in this form (Odor,1986). Computer programs were also written to provide and control a 'proforma' into which each component of an

event was entered and stored, and also to check the completeness and coherence of the overall set of entries.

Using the simulation

The intention is to give students a realistic 'role preview' of being a first-year student in higher education, and also to introduce them to concepts which will provide a vocabulary for describing their studying. The game itself is intended to provoke discussions among students about the strategies used in the game, and their applicability in everyday studying. The recognition of strengths and weaknesses in their own approaches to studying, and of the implications of their own stylistic preferences in learning, should lead students to be more reflective about their purposes, effort, and strategies, and also to review more carefully what they are currently achieving (Hounsell, 1979, 1984; Selmes, 1987).

As the final scenes are still being written, and the 'interpreter' to drive the simulation on the computer is as yet incomplete, it is impossible to report how students react to the simulation. Once the game is operational, however, samples of students in their final year at school, and in the first-year of higher education, will be asked to use it. Their interactions with, and their comments on, the game will be recorded and used to explore how best to use the game, how to improve its presentation, and also to evaluate its effects on everyday studying.

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